A. F. POOLE.

ACCOUNTING SYSTEM.

APPLICATION FILED APR. 9, 1910.

1,084,661.

Patented Jan. 20, 1914.

4 SHEETS—SHEET 1.

Fig. 6.

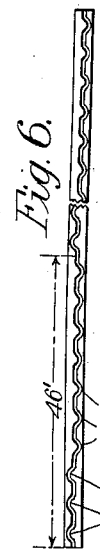


Fig. 1.

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4 SHEETS—SHEET 2.

Fig. 3.

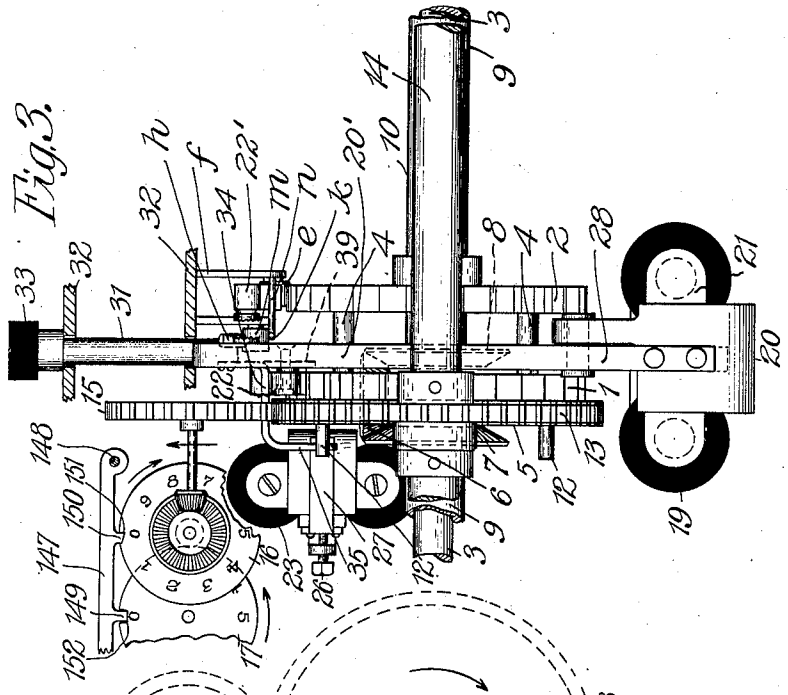
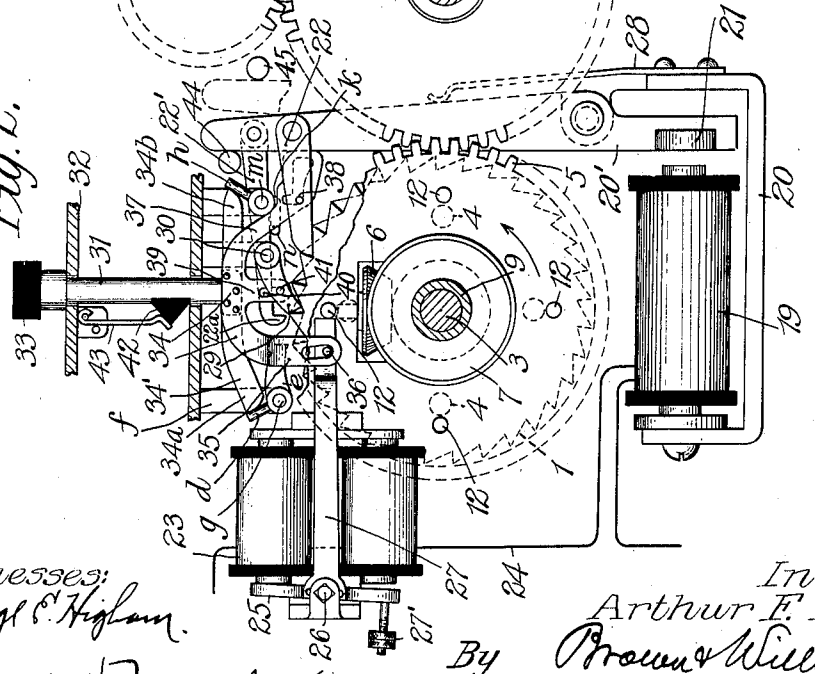


Fig. 2.



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4 SHEETS—SHEET 3.

Fig. 5.

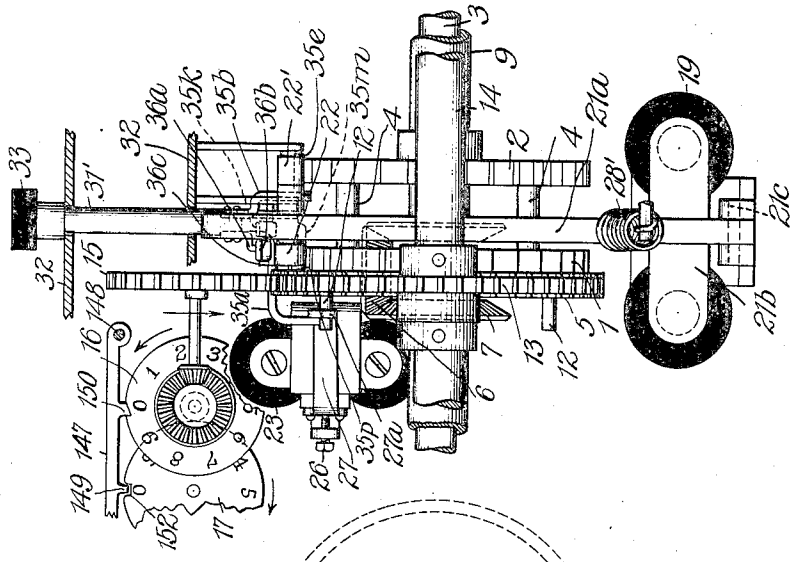
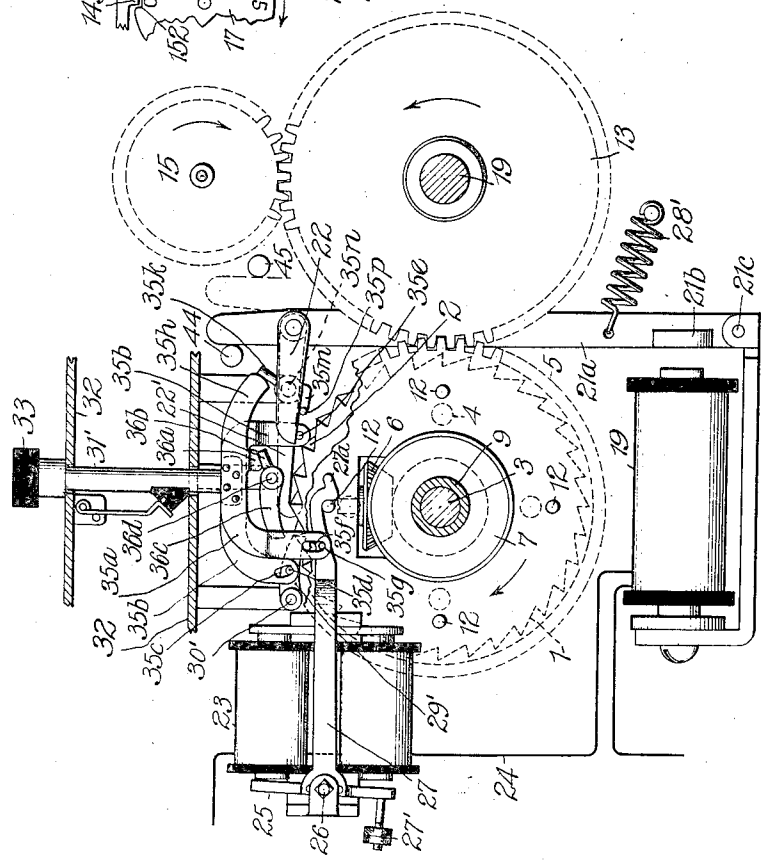


Fig. 4.



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4 SHEETS—SHEET 4.

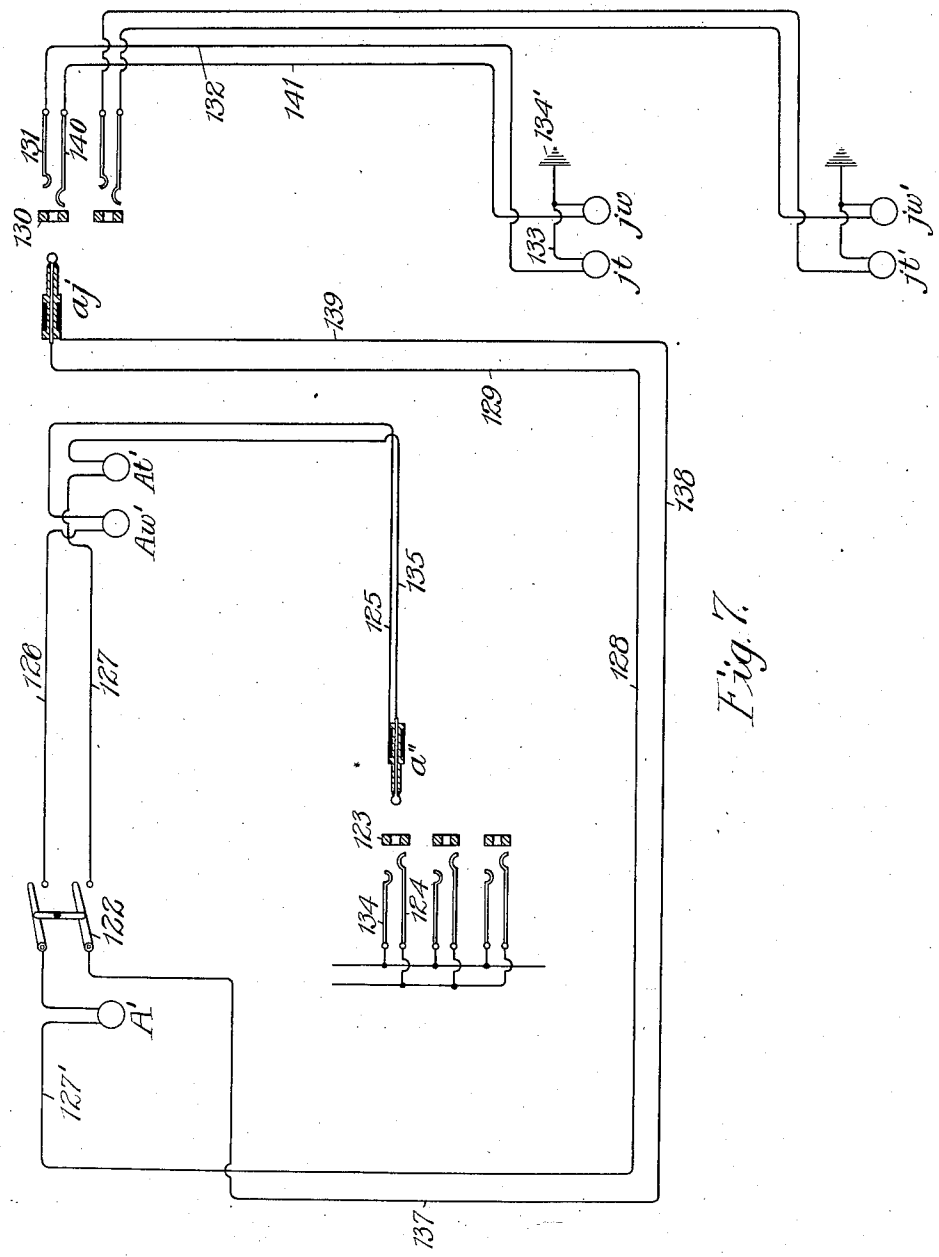


Fig. 7.

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UNITED STATES PATENT OFFICE.

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ACCOUNTING SYSTEM.

1,084,661. Specification of Letters Patent. Patented Jan. 20, 1914.

Application filed April 9, 1910. Serial No. 554,560.

To all whom it may concern:

Be it known that I, ARTHUR F. POOLE, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Accounting Systems, (Case 2ª,) of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to an electro-mechanical system of accounting for automatically taking account of an employee's time and wages.

In particular my invention comprises a system of accounting in which the individual wage and time registers are actuated by a step by step movement, this actuation being controlled by electro-magnetic means. However, the totalizing registers connected with certain of the individual registers are operated through the medium of differential gearing which properly connects each totalizing register with its corresponding individual registers.

Furthermore, my invention contemplates a system whereby the particular rate at which a certain individual register shall be operated may be freely selected by simply inserting a connecting plug in any particular jack. The insertion of an employee's plug in any one of a series of jacks will, at predetermined intervals, cause the closing of a circuit through the corresponding register operating devices, to control the actuation of the registers associated with such devices.

In order to make provision for a number of different rates at which any given register may be operated, I employ a series of rate disks mounted upon a time controlled shaft. Each of these disks is provided with a peculiarly grooved periphery in which engages a contact closing device, so arranged that the rotation of the disk with which it is associated will cause movement of the device to one side or the other for the closing of the circuit which causes the operation of the electromagnetic devices that actuate the registers. Just how this is effected will become apparent when the description of the drawings is taken up in detail.

The system as herein set forth is distinguished mainly from the system that I have set forth in an application filed by me heretofore, in that in the present case decumulation of the registers, that is setting them back to their zero or starting positions, is accomplished electrically, while in said other case this decumulation is done by purely mechanical means.

These and other objects and advantages of my invention will become apparent as the specification proceeds.

In the accompanying drawings, wherein like reference characters are used to indicate corresponding parts, Figure 1 is a diagrammatic representation of one practical embodiment of my system, Fig. 2 represents in detail the register actuating device, Fig. 3 is a side view of the arrangement shown in Fig. 2, certain of the parts which in Fig. 2 are indicated in dotted lines being shown in full lines in Fig. 3, Fig. 4 shows in detail a register operating device constructed to actuate its associated register in the direction opposite to that in which the device indicated in Fig. 2 actuates its register, Fig. 5 is a side view of the arrangement shown in Fig. 4, Fig. 6 is a fragmentary view showing the development in plan of the periphery of one of the rate disks, and Fig. 7 shows a rearrangement of certain portions of the circuits in the diagram of Fig. 1.

In order that the operation of the system as illustrated in Fig. 1 may be more readily understood, I will first take up the description in detail of the register operating devices, as illustrated in Figs. 2, 3, 4 and 5.

Referring particularly to Figs. 2 and 3, a pair of ratchet wheels 1 and 2 are loosely mounted upon the shaft 3. These wheels are rigidly secured together by means of bolts 4, which also serve to suitably space the wheels apart. The teeth of these wheels extend in opposite directions, as is indicated in Fig. 3, and in that portion of Fig. 2 which is partly broken away. Rigidly mounted by the side of ratchet wheel 1 is the gear wheel 5. Pivotally mounted between these wheels is the bevel pinion 6 which meshes upon opposite sides thereof with the bevel gears 7 and 8 secured upon sleeves 9 and 10 loosely mounted on the shaft 3. Although I have not shown it so in the drawings, it is to be understood that the opposite ends of sleeves 9 and 10 are provided with gears similar to gears 7 and 8 to engage the differential pinions of the correspondingly associated register operating devices. I have not deemed it necessary to show a series of these register operating devices for the reason that with what is illustrated in the draw-

ings, it will be clear to understand how such devices may be connected up in series by means of differential gears so that the actuations of the number of these devices comprising the series will be totalized by a register connected therewith. In the instance shown the gear wheel 5 and the ratchet wheel 1 are secured together by means of screws or bolts which form lugs or projections 12. The purpose of these lugs will be presently set forth.

As seen from Figs. 2 to 5 the gear wheel of each register operating device is adapted to mesh with the gear wheel 13 mounted upon a counter-shaft 14, suitably supported. This gear wheel 13 engages with a gear 15, which in turn is operatively connected with the first of a series of properly interconnected indicating wheels of which two, 16 and 17, are shown. It has not been thought necessary to show the entire train of wheels for the reason that this is a mechanism very well known and understood in the art. An electromagnet 19 is mounted in appropriate relation to the ratchet wheels 1 and 2. Pivoted to the frame 20 of the support for the electromagnet is the armature rod 20′ which carries the armature 21. At its outer end this rod has pivotally connected therewith the pawls or dogs 22 and 22′. As viewed in Figs. 2 and 4 the pawl 22 is pivoted to the rod 20′ on the side toward the observer while the pawl 22′ is pivoted to said rod on the opposite side, that is away from the observer. This position of the two pawls is also made clear in Figs. 3 and 5. The arrangement of these pawls on the bar 20′ is such that the pawl 22 may be brought into engagement with the teeth of the ratchet wheel 1, while the pawl 22′ may be brought into engagement with the teeth of the ratchet wheel 2. Inasmuch as the teeth of these ratchet wheels extend in opposite directions, it is, of course, necessary that the outer ends of these actuating pawls be shaped differently to correspond to the direction of the teeth. Both of these actuating pawls 22 and 22′ are loosely pivoted on the armature rod 20′ and by gravity tend to drop into engagement with the teeth of their respective ratchet wheels. Thus in Fig. 2 the pawl 22 is in engagement with the teeth of the ratchet wheel 1. In Fig. 4 the actuating pawl 22′ is shown in engagement with the teeth of the ratchet wheel 2. In Fig. 2 the normal positions of the pawls 22 and 22′ are just the reverse of the normal positions indicated in Fig. 4. This difference is due to a modification in the structure shown in Fig. 2 over that shown in Fig. 4. The object of this modification will be presently described. A second electromagnet 23 is mounted in proximity to the ratchet wheels in the relation shown in Figs. 2 to 5. This electromagnet 23 is polarized, and its windings are in series with the windings of the electromagnet 19. This series arrangement of the windings of the two electromagnets is indicated in Figs. 2 and 4 by the wire connection 24. The armature 25 of electromagnet 23 is pivoted to a suitable framework at 26 and is provided with an arm or extension 27. The lower end of the armature 25 is provided with an adjustable counter-weight 27′.

A sufficient number of parts of the register operating device as shown in Fig. 2 has now been described to afford an understanding of the operation of the device so far as its actuation of the associated register is concerned. Suppose that the circuit through the electromagnets has been closed momentarily. The electromaget 23, thus energized, will cause the armature 25 to be rocked so that the lower end of the same will be drawn against the lower pole piece of the electromagnet. With the armature in this position, the center of gravity will, by virtue of the counter-weight 27′, have been thrown to the right of the pivot 26. This rocking of the armature will lift the arm 27 upwardly out of the path of the top lug 12. At the same time the electromagnet 19 will also be energized and in attracting its armature, the bar 20′ will be rocked into the position indicated in dotted lines in Fig. 2. This will cause the actuating pawl 22 to drop into the next lower tooth of the ratchet wheel 1. When the circuit through the windings of the electromagnets is interrupted, the bar 20′ will be forced to the left through the action of a spring 28, thereby causing the pawl 22 to move the ratchet wheel 1 the distance of a tooth to the left, that is to say, in the direction indicated by the arrow in Fig. 2. The interruption of the circuit through the electromagnets will not affect the position of the armature 25 for the reason that gravity will retain it in the position to which it was moved when the first energization of the electromagnet 23 took place. Therefore, during the successive energizations of the electromagnet 19, the arm 27 will remain out of the path of the lugs 12 except as hereinafter specified.

Movement of the ratchet wheels 1 and 2 in a direction contrary to that indicated by the arrow in Fig. 2 is prevented by the retaining pawl 29 pivoted to a suitable support at 30. This pawl is kept by gravity in the path of the teeth of the ratchet wheel 1 and while it permits movement of the same in the direction indicated by the arrow, it positively prevents rotation in the opposite direction as may be clearly gathered from what is shown in Fig. 2. Now it may be necessary at certain times to decumulate the register, that is to say, to bring it back to zero. In this event, it is of course necessary that the ratchet wheels 1 and 2 be allowed to rotate together in a direction op-

posite to that indicated by the arrow in Fig. 2. To provide for this contingency I have arranged a rod 31, slidably mounted in the framework 32 and provided at its outer end with a manipulating knob 33. The lower or inner end of this rod has secured thereto a pair of peculiarly shaped extensions 34 and 34′. These extensions 34 and 34′ are secured to the rod upon opposite sides of the lower end thereof, as may be clearly seen in Fig. 2, the extension 34 being arranged toward the observer on the rod 31. The arm 35 of this extension is slotted at its free end and engages a lug 36 on the arm 27 of the armature 25. The arm 37 of this extension engages at its slotted outer end the lug 38 on the actuating pawl 22. The central projection 39 of the extension 34 has a slot 40 at the bottom of which rests the lug 41 on the retaining pawl 29. This lug and slot engagement between the rod 31 and the retaining pawl 29 permits the latter to ride over the teeth of the ratchet wheel 1. When the rod 31 is pulled out it will carry with it the arm 27, the retaining pawl 29 and the actuating pawl 22, all by virtue of the engagement between the different portions of the extension 34 and the parts 27, 29 and 22. In other words, when the rod 31 is moved upwardly, the arm 27 is moved out of the path of the projections 12, the retaining pawl 29 is moved out of the path of the teeth on the ratchet wheel 1, as is also the actuating pawl 22. In order that the rod 31 may not be accidentally moved from one position to the other, I supply a retaining means in the shape of a wedge shaped block 42 on the rod and the coöperating spring 43 carried by the support 32. With the rod in the position shown in Fig. 2, the tendency of the spring 43 is to hold it in that position, while with the rod in its drawn out position, the spring 43 will engage with the opposite side of the block 42 and tend to retain the rod in its elevated position. The movement of the armature rod 20′ is limited by the lugs 44 and 45 secured to a suitable support. The extension 34′ engages at its end 34*a* the lug *d* of the retaining pawl *e*, which is pivoted to the support *f* at *g*. The opposite end 34*b* of the extension 34′ engages the upwardly extending portion *h* of the peculiarly shaped retaining member *k* pivoted to a suitable support at *m*. This member *k* has a laterally extending portion *n* which with the parts in the position shown in Fig. 2 prevents the actuating pawl 22′ from dropping into engagement with the teeth of the ratchet wheel 2. Also by means of the engagement between the lug *d* and the portion 34*a* of the extension 34′, the retaining pawl *e* is prevented from dropping into engagement with the teeth of the ratchet wheel 2. When the rod 31 is pulled out, besides actuating the parts 27, 29 and 22, it will move the ends of the extension 34′ out of engagement with the lugs *d* and *h* with the result that retaining pawl *e* will drop into engagement with the teeth of the ratchet wheel 2, while actuating pawl 22′ will likewise be permitted to drop by gravity into the path of a tooth of the ratchet wheel 2. Therefore, with the rod 31 thus drawn up, should energization of the magnet 19 take place, the rocking of the upper end of the bar 20′ to the position indicated in dotted lines in Fig. 2 will cause the ratchet wheels 1 and 2 to be moved a distance of one tooth in a direction opposite to that indicated by the arrow in said figure. This movement is due to the fact that the downwardly extending end 22*a* of the pawl 22′ will drag with it the ratchet wheel 2 upon movement of the bar 20′ to the position indicated in dotted lines. When the magnet is deënergized the armature bar 20′ will be moved to the left by the spring 28 into the position in which it is shown in full lines in Fig. 2, but this movement will permit the actuating pawl 22′ to ride over the teeth of the ratchet wheel 2, while the retaining pawl *e* will prevent the ratchet wheel from moving in the reverse direction, that is to say, in the direction indicated by the arrow in Fig. 2.

It will now be apparent that with the rod 31 in its normal position as indicated in Fig. 2, repeated energization of the magnet 19 will cause the ratchet wheels 1 and 2 to move in the direction indicated by the arrow, but with the rod 31 in its drawn out position, repeated energization of the magnet 19 will cause the step by step movement of the ratchet wheels 1 and 2 in a direction opposite to that indicated by the arrow. Thus I provide an arrangement whereby the register actuating device has its movement in one direction or the other controlled electrically so that by simply pulling out the rod 31 and sending current impulses through the electromagnet 19, the register associated with the operating device may be decumulated, that is brought back to zero, by virtue of the current impulses which cause the register to accumulate when the rod is in its normal or inner position, as shown in Fig. 2. The circuit arrangements whereby the current impulses are sent through the electromagnets at the proper intervals will be described later.

The rate of actuation of the register associated with the particular actuating device will, of course, depend upon the number of circuit interruptions that occur in a given time. The means for causing a predetermined number of current interruptions to take place in a given time through the windings of the register operating magnet is shown in Fig. 1, and comprises a series of what I term rate disks 46, 47, 48, mounted

upon the time controlled shaft 49. It will be observed that each of these disks is provided with a periphery that is grooved in a peculiar manner. In order to understand best the purpose and object of the outline of the peripheral grooves on each disk, attention is directed to the illustration given in Fig. 6. The distance indicated by the dotted line 46′ represents the developed periphery of the rate wheel or disk 46. Looking at the groove or channel bounded by the line 46′, it will be seen that there are three upwardly projecting portions 46*a*. Of course when I say "upwardly" I use the term with reference to Fig. 6 only, it being understood that the direction in which these projections extend depends upon the direction in which the disk is viewed. Following these three upward projections in the peripheral groove or channel of the disk 46 is a series of seven projections deviating in a direction opposite to that of the projections 46. For the present it is sufficient to say that each one of these projections or deviations, as they might as well be called, in the groove of disk 46 represents an approximately momentary closing of the circuit through the windings of the electromagnets 19 and 23. However, inasmuch as deviations 46*a* are in a direction opposite to that of the deviations 46*b*, it will be apparent that the first three current impulses sent through the windings 19 and 23 will be opposite to the seven succeeding impulses, but inasmuch as the electromagnet 19 is a non-polarized one, the particular direction of the current traversing this winding has no effect upon its attraction of the armature 21. This, however, is not the case with the polarized electromagnet 23. Starting with the first current impulse, the energization of the magnet 23 will be such that the armature 25 will be rocked to cause the lower end thereof to be drawn against the opposing pole, as already mentioned. The second and third impulses through the electromagnet 23 will not disturb the position of the armature brought about by the first impulse, for the reason that the tendency of these second and third impulses would be to draw the armature into the same position into which it was drawn by the first impulse. However, the fourth impulse, which in Fig. 6 may be said to be represented by the first of the downwardly extending deviations 46*b*, will rock the armature 25 into the position indicated in Fig. 2. Inasmuch as the succeeding impulses, namely impulses 5 to 10 inclusive, are in the same direction as the fourth impulse, the armature 25 will remain in the indicated position and leave the arm 27 in the path of the lugs 12. As indicated in Fig. 6 where the distance marked off by line 46′ includes the developed periphery of the disk 46, after the tenth current impulse has been sent through the electromagnets of the register operating device, the next impulse will be the one represented by the first of the deviations 46*a*. This means that after ten current impulses, (which, of course, are essentially accompanied by corresponding current interruptions), have been sent out into the windings of the electromagnets, the eleventh impulse would be identical, so far as graphic representation is concerned, with the first impulse represented by the first of the three deviations 46*a*′. From this it might truly be said that ten current impulses, (or ten current interruptions) constitute what might really be termed a "cycle." I find this term not only to be correct in properly expressing the current impulses or interruptions, but I find it convenient to explain how the other rate wheels or disks produce different rates of operation of the corresponding registers.

For the sake of presenting a concrete illustration it might be supposed that the disk 46 actuates its corresponding register at a rate which represents five cents an hour, which the corresponding wage register would indicate. If, therefore, disk 46 represents a five cent rate and the number of current interruptions caused by the disk during one rotation thereof is equal to ten, or one cycle, it is plain to see that the disk 47, if it is to represent a ten cent rate, must have a periphery so grooved that it will cause during one rotation thereof, twice the number of current impulses or interruptions to be sent through the windings of the particular register actuating device. By looking at Fig. 1 it will be seen that the deviations in the peripheral groove of the disk 47 are more frequent than the deviations in the grooved periphery on the disk 46. Although the entire grooved periphery has not been shown, yet the part that is shown is intended to show the number of deviations necessary to make the disk represent double the rate of disk 46. The fragment at the right of Fig. 6 is intended to represent, in conjunction with the adjacent fragment, a development, partly broken away, of a disk representing a higher rate than that represented by disk 46. Disk 48 has been assumed to represent a fifteen cent rate. In order to do this it will be clear that the disk must cause three times the number of current interruptions caused by the disk 46, or, to put it in the phrase of cycles, the grooved periphery of disk 48 must represent three cycles if it is to have a rate three times that of the disk 46, the latter representing but one cycle, as already pointed out. Of course the five, ten and fifteen cent rates have been chosen in this instance merely for the sake of illustration and any convenient ratio of rates may be adopted. To do this it is merely necessary to make the proper arithmetical calculations with respect to the num-

ber of deviations in the grooved peripheries on the several disks.

Mounted on the time controlled shaft 49 is also the time disk 50 which is similar in construction to the rate disks. As will be seen from Fig. 1, the grooved periphery of this time disk is identical with the grooved periphery on the disk 47. This is purely a coincidence and is the result of the assumptions of the different rates to be represented by the rate disks, together with the assumption of a certain speed at which the shaft 49 is to be driven. To put it concretely—for the sake of illustration I have assumed that the time shaft makes one revolution in $\frac{4}{10}$ths of an hour. For convenience I have adopted $\frac{1}{10}$th of an hour as the unit of time, and a five cent rate as the unit of wages, or in other words, the unit of time and the unit of wages are each represented by a cycle, that is to say by ten current impulses or interruptions. Inasmuch as the time shaft represents in one revolution two units of time, disk 47 will represent two units of wages because each of these disks represents two cycles. It is for this reason, therefore, that in the instance shown, the number of deviations on the periphery of the time disk is the same as the number of deviations on the periphery of the rate disk, 47. Upon other assumptions to start with than those above mentioned, the time disk will, of course, have its own peculiar number of deviations.

In connection with the detailed construction of the register operating devices there remains to be described the object and purpose of the electromagnet 23, the arm 27 on whose armature is, at certain intervals, in the path of the lugs 12 on the ratchet wheel, as indicated in Fig. 2. This mechanism has to do with the maintenance of effective synchronism between the various registers and their actuating mechanisms, and between these devices and the clock controlled source of impulses. The principles of operation and the mechanism employed for this purpose are disclosed in my United States Patent No. 707,253, issued September 2, 1902. It will be observed that there are four of these lugs 12 spaced at equal intervals. The number of teeth on each of the ratchet wheels 1 and 2 is 32, so that eight teeth will occur in the arc comprehended by any two adjacent lugs. In order to operate properly it is of course necessary that the ratchet wheel be moved one tooth at every current interruption, but it might be for some reason or other that this proper operation does not take place. In order, therefore, that there may be synchronism between the speed of rotation of the shaft 49 and the step by step movement of the ratchet disk, I have provided a synchronizing arrangement in the shape of the electromagnet 23 and its appurtenances. In order to understand how the electromagnet effects such synchronism let it be assumed that the parts as shown in Fig. 2 are ready for operation upon the beginning of a cycle of impulses. The first impulse sent through the windings 19 and 23 will, as already mentioned, rock the armature 25 to move the arm 27 out of the path of the engaging lug 12. At the same time the electromagnet 12 will attract its armature 21 and cause the actuating pawl 22 to slide into engagement with the next lower tooth. Upon interruption of this momentary impulse the wheel will be moved one tooth. The second and third impulses being in the same direction as the first, the arm 27 will remain in its raised position, whereby the uppermost projection 12 will have had a chance to slip past the arm to the left. Now, if the actuating pawl 22 has moved the ratchet wheel one tooth ahead at every current interruption, then upon the eighth interruption the right hand projection 12 shown in Fig. 2 will be in the exact position in which the uppermost projection 12 was at the beginning of the cycle of operation. Of course, inasmuch as the fourth impulse of the cycle caused the armature 25 to be attracted to the position in which it is shown, the arm 27 will be in the path of the lugs during the period in which impulses 4 to 10 occur. Therefore at the eighth impulse, the lug 12 will have traveled through an arc of 90° and abut against the free end of the arm 27. Suppose, however, that for some reason eight current interruptions have caused the actuating pawl 22 to move the ratchet wheel only seven teeth. In this event at the eighth interruption the projection 12 will be the distance of one tooth away from the end of the arm 27, and in order to bring it into direct engagement with said arm, in other words, in order to make it complete its travel through an arc of 90°, a ninth impulse will be necessary. From this it will be seen that the ninth and tenth impulses of each cycle are what might be termed "emergency" impulses, which serve to operate the ratchet wheel only in case one or more of the first eight impulses has failed to produce operation of the ratchet wheel. Of course if the first eight impulses have caused the actuating pawl to move the ratchet wheel through a distance of eight teeth, (in which event any one projection 12 will have traveled through an arc of 90°), the ninth and tenth impulses will be lost so far as producing operation of the ratchet wheel is concerned. This is due to the fact that under normal conditions, the projection 12 will at the eighth impulse be brought against the obstructing end of the arm 27. By thus making sure that every cycle represented on the disks 46, 47, 48 and 50, will cause the ratchet wheel of any particular register op-

erating device to be removed through a distance of eight teeth, I establish synchronism between the rotation of the time controlled shaft 49 on which the disks are mounted and the actuation of the ratchet wheel of each register operating device.

It will be readily apparent that if the ratchet wheels of the register actuating device as shown in Fig. 2 are normally actuated to move in the direction indicated by the arrow in Fig. 2, the ratchet wheels of the next of a series of register operating devices must move in an opposite direction, because of the differential connection at each register actuating device. Of course the ratchet wheels of the third register actuating device of the series will normally operate in the same direction as the first. When I refer to the normal operation of the actuating device I mean the operation during which the register is made to accumulate, as distinguished from decumulating.

The construction shown in Figs. 4 and 5 is for a register actuating device so modified from the construction shown in Fig. 2 that it will normally operate in the direction indicated by the arrow in Fig. 4, which direction, it will be observed, is contrary to that indicated by the arrow in Fig. 2. It will be noted that in Fig. 4 the arm or extension 21*a* which carries the armature portion 21*b* is pivoted at 21*c* so that upon energization of the magnet arm 21*a* will be rocked to the left into the position shown in full lines. This movement of the arm 21*a* to the left will allow the actuating pawl 22′ to ride over the periphery of the ratchet wheel 2 into engagement with the next tooth on the left. Upon deënergization of the magnet, the spring 28′ will draw the arm back to the right into the position partly indicated in dotted lines. This movement of the arm 21*a* to the right will cause the pawl 22′ to drag with it the ratchet wheel through the distance of one tooth, in the direction indicated by the arrow. Backward movement of the ratchet wheel is prevented by the retaining pawl 29′ pivoted at 30′. In order to cause the proper projection 12 to rest against the obstructing end of the arm 27′ at the eighth circuit interruption of the cycle, I have given this end of the arm 27 the shape indicated at 27*a*, in Fig. 4. This downwardly projecting portion 27*a* constitutes a barrier to the further travel of the associated projection 12 when the two parts have arrived in engagement with each other. The rod 31′ is adapted to lift the arm 27′, retaining pawl 29′ and actuating pawl 22′ out of engagement with their coöperating parts of the ratchet wheel. The lower end of the rod 31′ is provided upon opposite sides thereof with a pair of peculiarly shaped extensions 35*a* and 35*b*, the latter being behind the former, as viewed in Fig. 4, or to the right of the former as viewed in Fig. 5. The extension 35*b* is at one of its ends provided with a slot 35*c* in which rests the lug 35*d* on the retaining pawl 29′. The opposite end of the extension 35*b* is provided with a lug 35*e* resting beneath the pawl 22′. The extension 35*a* is at one end provided with the slot 35*f* which engages with the lug 35*g* on the arm 27′. The opposite end 35*h* of the extension 35*a* engages the upwardly extending portion 35*k* on the retaining member 35*m*, this member is pivoted to a suitable frame at 35*n*, and is provided with a lateral extension 35*p* which with the parts as shown in either position in Fig. 4 prevents the retaining pawl 22 from dropping into the path of the teeth on the ratchet wheel 1. The central projection 36*a* on the extension 35*a* engages the lug 36*b* on the retaining pawl 36*c* pivoted at 36*d*. In this way the retaining pawl 36*c* is normally kept away from the teeth of the ratchet wheel 1. From this it will be seen that upon pulling out the rod 31′, the arm 27′, retaining pawl 29′ and actuating pawl 22′ will be moved and held out of engagement with the ratchet wheels 1 and 2. At the same time this upward movement of the rod will remove the projection 36 out of engagement with the lug 36*b* and also move the end 35*h* out of engagement with the lug 35*k*. The result will be that retaining pawl 36*c* will be permitted to drop into the path of the teeth on the ratchet wheel 1 and the actuating pawl 22 will be permitted to engage the teeth on the same ratchet wheel. With the parts in this last named position, it is evident that the repeated energizations of the electromagnet 19 will cause a step by step movement of the ratchet wheels in a direction opposite to that indicated by the arrow in Fig. 4. The movement of the ratchet wheels in the last named direction is necessary in order to decumulate the registers.

Upon a comparison of Figs. 2 and 4, the following facts present themselves: In Fig. 2 during normal operation of the register actuating device, it is the actuating pawl 22 which moves the ratchet wheels in the direction indicated by the arrow to cause the register to accumulate. In Fig. 4 it is the pawl 22′ which normally actuates the ratchet wheel 2, and with it, of course, the ratchet wheel 1 to cause the associated register to accumulate. The decumulating position of the parts of the device shown in Fig. 2 is when the pawl 22 is out of engagement with the ratchet wheel 1 and the pawl 22′ is in engagement with the ratchet wheel 2. In Fig. 4 on the contrary, the decumulating position of the parts is when the pawl 22 is in engagement with the ratchet wheel 1 and the pawl 22′ is out of engagement with the ratchet wheel 2.

Referring to the mechanism for driving

the shaft 49′ at a resultant uniform speed, I connect the motor 51 with the shaft 49′ through a series of reducing gears 52. The shaft 49 is connected with the shaft 53 through a set of differentials 54. The shaft 53 is adapted to be directly actuated by a master clock 55. The motor is fed from the mains 56, and with the resistance 57 short-circuited will rotate at a higher rate of speed than the shaft 53. In this case the central wheel of the set of differentials 54 will rotate in a direction toward the observer. When the projection 58 on said wheel strikes the spring contact 59, it will move the same to the left, thereby forcing it out of contact with the terminal 60. This opens the short-circuit around the resistance 57 and causes the motor to slow down by virtue of the resistance 57 being placed in the circuit. With the motor thus slowed down, the shaft 49 will rotate at a lower speed than the clock driven shaft 53, with the result that the central wheel of the differentials 54 will rotate in the opposite direction, thereby moving the projection 58 away from the spring blade 59 and closing the short-circuit around the resistance 57. This will cause the motor to speed up again and rotate the shaft 49 at a higher speed than the speed of the shaft 53. Of course it will be understood that although the shaft 49 will rotate at speeds that are now higher than the uniform speed of the shaft 53, yet the resultant rotation of the shaft 49 will be the same as the rotation of the shaft 53, thereby producing rotation of the disks 46, 47, 48 and 50 at a uniform rate of speed.

I will now describe in detail the operation of my system as represented in the embodiment shown in Fig. 1. Associated with the grooved peripheries of disks 46, 47, 48 and 50 are spring contacts 61, 62, 63 and 64, respectively. The free ends of these contacts engage in the peripheral grooves on these disks, and as the disks are rotated these contacts are moved to one side or the other, according to the deviations in the grooves. When spring contact 61 is moved to the left, it engages contact 65, and when moved to the right it engages contact 66. Similarly a pair of contacts 67 and 68 are associated with the spring blade or contact 62, a pair of contacts 69 and 70 are associated upon opposite sides of the contact 63, and finally a pair of contacts 71 and 72 are associated with contact 64. It will be observed that contacts 69, 67, 65 and 71 are all connected with the conductor 73 which leads to one terminal of the battery 74. The contacts 72, 66, 68 and 70 are all connected with the conductor 75 which leads to the opposite terminal of the battery 74. The battery is, for convenience shown grounded at 76. Contact 64 of the time disk 50 is connected with conductor 77, to which are connected all the tip contacts 78 of the series of jacks shown. The contact 63 is, by means of the conductor 79, connected with the conductor 80. To this conductor are connected the three sleeve contacts 63′. The contact 61 is connected by means of conductor 81 with conductor 82 which has connected thereto the three sleeve contacts 61′. Contact 62 is connected by conductor 83 with conductor 84 which has connected thereto the three sleeve contacts 62′. It will thus be seen that the series of nine jacks shown in the figure is divided into three groups of three jacks each. Of course, it will be understood that this precise number in the series and the division into a certain number of groups is purely arbitrary, it having been resorted to in this instance solely as a matter of illustration. In order to avoid unnecessary multiplication of circuits in Fig 1, I have confined myself to setting forth an embodiment of my invention as it would be used in the case of three workmen or employees whose time and wages are to be taken into account. The number of jacks in the series, of course, depends upon the number of employees of whose time and wages the system is arranged to take care. The number of groups into which the series of jacks is divided depends upon the number of different rates at which workmen are employed in any particular factory or place of employment. Inasmuch as I have selected three different rates, the series of jacks is naturally divided into three groups, each group representing a particular rate. Thus, for instance, the first group of jacks whose sleeve contacts are indicated by 62′ represents the rate of the wheel 47. In the particular instance given this would be a ten cent rate. The group of jacks whose sleeve contacts are indicated by 61′ represents the rate of the disk 46. Finally the group of jacks whose sleeves are indicated by 63′ represents the rate of disk 48.

Suppose now that the plug *a* has been inserted as shown. In this case the wage register that will be actuated because of the insertion of the plug will operate at the rate represented by wheel 47. The circuits may be traced as follows: For the sake of convenience we start at the ground 76, through the right half of the battery, through conductor 75, into conductor 75′ to the point 75″. At this point, assuming that the position of the disk is such that the spring blades 64 and 62 will be forced to the right into contact respectively with 72 and 68, the current divides as follows: A portion flows through contact 68, across the contact 62 into conductor 83, into conductor 84, thence to the sleeve contact 62′, from there into conductor 85, through the wage register *Awc*, into conductor 86 to the point 87. If the workman's switch 88 is closed, the current will find the ground through conductor 89 at 90. The circuit as thus traced will ac-

tuate the wage register A*w*. The other portion of the current which divided at the point 75″ will flow as follows: Into conductor 75′ to contact 72, over to contact 64, to conductor 77 to the tip contact 78, thence into conductor 92, through the time register A*t*, conductor 91′, through the workmen's individual time register A and from there to the ground through 89 and 90. This last traced circuit, it will be noted, will actuate the workmen's individual time register A as well as the corresponding time register A*t*. In order to trace the circuits completed by the plug *a* when the time shaft is in such a position that the spring blades 64 and 62 are forced to the left into contact respectively with 71 and 67, let us begin as before with the ground 76, thence through the left half of the battery, through conductor 73 to the point 73′. Here the current divides, a portion of it being traced through conductor 73″, contacts 67 and 62, conductors 83 and 84, sleeve terminal 62′, conductor 85, wage register A*w*, conductor 86, switch 88, thence to the ground through 89 and 90. The other portion of the current from the point 73′ is traced through contact 71 and 64, conductor 77, tip contact 78, conductor 92, time register A*t*, conductor 91, workmen's individual time register A, thence through switch 88 and conductor 89 to ground 90. From this it will be seen that this last set of circuits is substantially identical with the first set of circuits traced, the only difference being in the portions of the circuits passing through the spring contacts 64 and 62, which contacts are moved either to the left or to the right, according to the position of the rate disks, and the time disks. From what has been explained before with regard to the configurations of the grooves on the peripheries of the time disks and the rate disks, it will be observed that during one cycle the contacts will be moved first three times to the right, then seven times to the left. From the tracing of the above circuits it will be clear what the circuits would be if plug *b* or plug *c* were inserted in the jack in which plug *a* is shown inserted in Fig. 1. Of course if we imagine plug *b* inserted in the first jack, the circuits would pass through the wage register B*w* and the time registers B and B*t*. The circuits through these registers may be readily traced thus: from the sleeve of plug *b* into conductor 91, through register B*w*, conductor 92, through switch 93, (provided the same is closed, as it would be upon the workmen's arrival), thence into conductor 89 to ground 90. From the tip of plug *b* the current may be traced through conductor 94, through time register B*t*, conductor 95, time register B, switch 93 to ground 90. The circuits from ground 76 of the battery to tip and sleeve of the plug *b* would be the same as those described in connection with plug *a*. As previously mentioned the series of jacks is divided in the present instance, into three groups of three jacks each, each series representing a certain rate. As shown in the drawings, plug *a* is inserted in the first group, which means that the wage register controlled by the plug operates at a ten cent rate. Now plug *a* might be inserted in any jack of the other groups to cause the wage register A*w* to operate at a different rate. To illustrate this operation at a different rate I have shown the plug *c* inserted in the group of jacks which corresponds with the five cent rate. Let us now trace the various circuits with the plug *c* in the position shown in Fig. 1: Starting with ground 76, current will pass through the right half of the battery into conductor 75, thence into conductor 75′ to the point 96. At this point the circuit divides, one portion passing into contact 66 over to contact 61, (during the portion of the cycle in which the contact 61 is forced to the right by the deviations in the grooves), thence into conductor 81, conductor 82, sleeve contact 61′, conductor 97, wage register C*w*, conductor 98, switch 99, (which of course would be closed,) thence to the ground 90. The other portion of the circuit that divided at the point 96 is traced as follows: point 96, contacts 72 and 64, (during that portion of the cycle in which the contact 64 is forced against the contact 72), thence into conductor 77 to the tip contact 78, through the tip of the plug into conductor 100, time register C*t*, conductor 101, into the workmen's individual time register C, and thence through switch 99 to the ground. During that portion of the cycle in which the spring contacts working in the grooves on the disks are forced to the left, as viewed in Fig. 1, the circuits would be the same except that instead of passing through the right half of the battery, the circuits would be traced from the ground through the left half, as already indicated in connection with certain circuits traced through the plug *a*. From the circuits that have thus far been traced, it will be noted that plug *a* controls registers A, A*t* and A*w*; plug *b* controls registers B, B*t* and B*w*; and plug *c* controls registers C, C*t* and C*w*. In other words, the particular plug assigned to each workman will control his particular registers. As may be seen from Fig. 1, any one of the plugs *a*, *b* and *c* may be inserted in any one of the series of jacks so that a register of any workman may be made to operate at any one of the desired rates. Thus if it is desired that the workman whose plug is *a* shall work at say a fifteen cent rate, all that is necessary is to take plug *a* and place it in any one of the group of jacks

representing that particular rate. In the instance illustrated that group comprises the last three of the series of jacks.

At this time I desire to call attention to the diagrammatic representation of the registers in Fig. 1. It is intended that the circles A, A*t*, etc., together with their corresponding gear connections indicate diagrammatically the register operating devices and their appropriate gearing, as shown in Figs. 2, 3 and 4. The time registers A*t*, B*t* and C*t* totalize into the summation time register T in order to have an indication of the total amount of time consumed by the workmen, as shown by each workman's individual register. The only difference between the time registers A, B, and C and time registers A*t*, B*t* and C*t* is that the first set of time registers has each register independent of the other, while in the second set of registers the registers are differentially geared together so as to control the actuation of the summation register. The summation wage register W*t* is geared to the individual wage registers A*w*, B*w*, and C*w*, to indicate the total or sum of their actuations.

The six registers indicated at the right of Fig. 1 are intended to represent jobs. The registers *j*1, *j*2 and *j*3 give indications of what might be distinguished as job J, while the registers *j*4, *j*5 and *j*6 are to indicate another job J′. In the present instance I have shown but two jobs, although it is apparent that any number of separate jobs might be represented by the necessary registers. Furthermore I have shown three registers for each job. This is simply because, by way of example, I have illustrated but three workmen's registers. Suppose it is desired to put a workman whose plug is *a* on job *j*. In that case plug *a* being in the position in which it is shown for the sake of illustration, in Fig. 1, it would be merely necessary to place plug *a*′ in one of the jacks 102, 103, or 104, these jacks controlling respectively the job registers *j*1, *j*2 and *j*3. If, now, plug *a*′ be inserted in the jack 102, the circuit through the job register *j*1 would be traced as follows: From conductor 85, the circuit as previously traced in connection with plug *a* would divide at the point 105, a portion of it passing into the wage register A*w*, as previously described, the other portion passing from point 105 into conductor 106, the tip of plug *a*′, tip contact 107, conductor 108, through job register *j*1, conductor 109, the sleeve contact 110 of jack 102, through the sleeve of plug *a*′, conductor 111 to switch 88, thence through conductor 89 to the ground 90. Inasmuch as the rate at which the register or registers controlled by the plug *a*′ is primarily determined by the particular jack into which the plug is inserted, it is evident that the particular job register controlled by a plug *a*′ would essentially operate at the same rate as the wage register controlled by the plug *a*. Inasmuch as it is the plug *a* that determines the rate of actuation of the corresponding wage register any job register which may be placed in circuit by the plug *a*′ can operate only at the same rate at which the wage register is operating, as determined by the plug *a*. The job plug *b*′ is associated with the workmen's plug *b* in the same manner that job plug *a*′ is associated with the plug *a*, as above described. Similarly the job plug *c*′ is associated with the workmen's plug *c*. With plug *b* inserted in any particular jack in the series, and the job plug *b*′ inserted in any particular jack in the job series, the circuit from the sleeve of plug *b* will divide at the point 112 in the conductor 91, part of it going through the wage register B*w*, as before described, and part of it following conductor 113 to the tip of job plug *b*′, from there it will pass into the particular job register and return through the sleeve of the plug *b*′ into conductor 114, thence through the switch 93 to the ground 90. The circuit through the job register *j*6 as completed by the job plug *c*′ with the workmen's plug *c* inserted as shown is traced as follows: At the point 115 in the conductor 97, the circuit from the sleeve of plug *c* divides, a portion passing through the wage register C*w*, as before described, the other portion passing from the point 115 into the conductor 116, to the tip of job plug *c*′ to the tip contact 117, conductor 118, controlled by the plug *a*′ would essentially operate at the same rate as the wage register controlled by the plug *a*. Inasmuch as it is the plug *a* that determines the rate of actuation of the corresponding wage register any job register which may be placed in circuit by the plug *a*′ can operate only at the same rate at which the wage register is operating, as determined by the plug *a*. The job plug *b*′ is associated with the workmen's plug *b* in the same manner that job plug *a*′ is associated with the plug *a*, as above described. Similarly the job plug *c*′ is associated with the workmen's plug *c*. With plug *b* inserted in any particular jack in the series, and the job plug *b*′ inserted in any particular jack in the job series, the circuit from the sleeve of plug *b* will divide at the point 112 in the conductor 91, part of it going through the wage register B*w*, as before described, and part of it following conductor 113 to the tip of job plug *b*′, from there it will pass into the particular job register and return through the sleeve of the plug *b*′ into conductor 114, thence through the switch 93 to the ground 90. The circuit through the job register *j*6 as completed by the job plug *c*′ with the work-

men's plug c inserted as shown is traced as follows: At the point 115 in the conductor 97, the circuit from the sleeve of plug c divides, a portion passing through the wage register Cw, as before described, the other portion passing from the point 115 into the conductor 116, to the tip of job plug c' to the tip contact 117, conductor 118, through the job register $j6$, conductor 117, sleeve contact 120, through the sleeve of plug c', into conductor 121, thence through the switch 99 to the ground, 90. Because of the parallel relation of the circuits through a particular wage register, and any job register associated with the workmen's register, by the insertion of a particular job plug, it follows that a wage register may be actuated without the corresponding actuation of any job register, so that a workmen's wage register may indicate the accumulation of wages, even though the workman has not been assigned to any job. The fact, of course, that a particular workman has not been assigned to any job may not by any means be his fault, but in case it is desired to have an arrangement whereby there will be no accumulation of wages unless the workman has been assigned to a job, the scheme shown in Fig. 7 may be resorted to. This figure shows only those circuits which are different from those indicated in Fig. 1.

In Fig. 7 let A′ indicate the workman's individual time register. Let it be assumed that the workman's switch 122 be closed and the plug a'' inserted in jack 123. The circuit would then be traced from the battery as described in connection with Fig. 1 to the sleeve contact 124, thence through the sleeve of the plug a'', into conductor 125, from there into the wage register Aw', through the conductor 126, individual time register A′, conductors 127, 128, 129, through the tip of job plug aj. Now unless this job plug is inserted in one of the job jacks, the circuit through the workmen's individual time register A′ and his wage register Aw' would not be completed, and the wage register will show no accumulation of wages. In order that this wage register may be actuated, it is necessary that the workman be assigned to some particular job. Let it, therefore, be assumed that this is the case and that the job plug aj is inserted in the jack 130. In this case the circuit would be traced from conductor 129, through the tip of plug aj, the tip contact 131, conductor 132, through the time register jt, conductor 133, thence to ground 134′, completing the circuit through the battery. The circuit from the tip contact 134 of the jack 123 is as follows: through the tip of plug a'', conductor 135, through the time register At', conductor 136, switch 122, conductors 137, 138, 139, sleeve of job plug Aj, sleeve contact 140, conductor 141, wage register jw, thence to the ground 134′. From this tracing of the circuits as arranged in Fig. 7, it will be observed that the workman's wage and time registers are in series with the corresponding wage and time registers of any particular job so that the circuits through these registers cannot be completed unless both the workman's plug and the job plug are inserted in the desired jacks. The modification presented in Fig. 7 shows the flexibility of my system as illustrated in the embodiment of Fig. 1.

Directing attention to Fig. 1, it will be observed that the job registers $j1$, $j2$ and $j3$ totalize into the register $j3$, while the individual job registers $j4$, $j5$ and $j6$ totalize into the summation register $j6$. These registers $j3$ and $j6$ totalize into the summation job register jt. The summation wage register Wt and the summation job register Jt are connected together by the differential gear 142. Now these summation registers are arranged to be actuated in opposite directions so that the register X actuated by the differential gear 142 will indicate the difference between the amount of actuation of register Wt and the amount of actuation of register Jt. Under normal conditions these registers should give corresponding indications so that the central wheel of the differential 142 would remain stationary and the register X remain idle. However, if any workman's plug has been inserted and his particular wage register accumulates without his having been assigned to a job, then the wage register Wt would give indications in excess of those given by the job register Jt, which excess would be indicated by the register X. It will thus be seen that this register X gives indications of the amount of workmen's time unassigned to jobs.

Suppose now that it is desired to decumulate the registers, that is to say, to bring them back to their zero positions. In this case the clerk or attendant that looks after this decumulation will pull out the rods 31 and 31′ of the register actuating devices. From what has been explained before it will be remembered that with the rods 31 and 31′ in their drawn out positions, the ratchet wheels of the registers will be actuated in a direction opposite to that in which they were actuated during the accumulation of the registers. After the rods have thus been pulled out, the switch S is closed, whereupon with the workmen's plugs and the necessary job plugs in their proper jacks, and with the shaft 49 operating to drive the rate disks and the time disk, the registers will be actuated, each in a direction opposite to that in which it was operated during accumulation. The circuits described in connection with the accumulation of the registers remain precisely the same during the

decumulation with the exception that the grounding will take place at 90′ through the switch S instead of at 90, as was the case during the normal operation of the registers. The reason for this is that during the decumulation the workmen's switches 88, 93 and 99 will, of course, be open, and the ground could not be reached through the conductor 89, so that by connecting the terminals 114′, 111′, and 121′ of the switch S with the conductors 114, 111 and 121 respectively, the ground is reached from these conductors through the switch at the point 90′.

In order to prevent decumulation of the registers below the zero position, I provide a locking bar 147, which is pivoted at 148. From as much as is shown of this bar in the drawings it will be seen to be provided with teeth 149 and 150. The third wheel in the train of indicating wheels in the register would be provided with a recess similar to the recess 151 on the wheel 16, in which recess rests the tooth 150, and, of course, the bar 147 would be provided with a tooth similar to the tooth 150 that would rest in the recess in the third wheel of the train. During accumulation the wheels 16 and 17 will rotate in the direction indicated by the arrows. A little rotation of the wheel 16 will force the tooth 150 out of the recess 151 and raise the bar 147. With the bar thus raised all of the teeth thereon will be out of engagement with the recesses on the wheels. In order to permit this initial movement of the wheels 16 to raise the bar, I make the recess 152 in the wheel 17 somewhat wider than the tooth 149, so that sufficient rotation of the wheel 17 is permitted to allow the wheel 16 to raise the locking bar. Upon decumulation the wheels will rotate in directions opposite to those indicated by the arrows in Fig. 3, and the moment the wheels have reached zero position the recesses in the wheels will come beneath the associated lugs or teeth on the locking bar 147, with the result that the teeth on the bar will drop into such recesses, thereby blocking the train of wheels against further rotation backward.

Because of the differential connection between the registers it matters not whether one register is brought to zero position sooner than some other register. As each register is brought to its starting or zero position, its train of wheels will be automatically locked by the bar 147, while the other register or registers will continue to decumulate until they have reached their zero position, whereupon they will be locked against further decumulation by their locking bars.

From the description of the embodiment of my invention herein shown, it will be apparent that the arrangement illustrated diagrammatically in Fig. 1 and the modification in Fig. 2 are merely shown by way of examples, as describing the principle and essence of my invention. Furthermore, although I have shown a specific form of synchronizing mechanism, it is by no means necessary to the purpose of my invention that such particular mechanism be employed. Any suitable form of synchronizing device may be used. Also it will be apparent that certain features of my invention may be used separately from certain other features, as pointed out in the appended claims.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In combination, a plurality of individual registers provided each with electromagnetic means for actuating the same in either direction, a source of electric impulses for periodically energizing said electromagnetic means to operate the registers at a rate determined by the frequency of the impulses, and a summation-register geared to said individual registers to indicate the total of the actuations of said individual registers.

2. In combination, a plurality of registers provided each with electromagnetic means for actuating the same in either direction, a source of electric impulses of predetermined frequency, and means for establishing in parallel readily separable circuit-connections between said source and any register or registers simultaneously to operate the same at a rate dependent upon said frequency.

3. In combination, a plurality of registers provided each with electromagnetic means for actuating the same in either direction, a source of electric impulses of predetermined frequency, a series of switch-terminals simultaneously connected in parallel with said source, and a coöperating contact-terminal connected with each register for establishing readily separable circuit-connections between said source and any register or registers to operate the same at a rate dependent upon said frequency.

4. In combination, a plurality of individual registers provided each with electromagnetic means for actuating the same in either direction, a source of electric impulses of predetermined frequency, means for establishing readily separable circuit-connections between said source and any register or registers to operate the same at a rate dependent upon said frequency, and a summation-register geared to said individual registers to indicate the total of the actuations of said individual registers.

5. In combination, a plurality of individual registers provided each with electromagnetic means for actuating the same in either direction, a source of electric impulses of predetermined frequency, a series of switch-terminals connected with said source, a cooperating contact-terminal connected with

each register for establishing readily separable circuit-connections between said source and any register or registers to operate the same at a rate dependent upon said frequency, and a summation-register geared to said individual registers to indicate the total of the actuations of said individual registers.

6. In combination, a plurality of registers provided each with electromagnetic means for actuating the same in either direction, means for simultaneously generating electric impulses of different frequencies, and readily controlled circuit-connections between said generating means and said registers for selectively determining the rate of actuation of any register.

7. In combination, a plurality of individual registers provided each with electromagnetic means for actuating the same in either direction, means for generating electric impulses of different frequencies, readily controlled circuit-connections between said generating means and said individual registers for selectively determining the rate of actuation of any register, and a summation register controlled by said individual registers to indicate the total of the actuations of said individual registers.

8. In combination, a plurality of individual registers provided each with electromagnetic means for actuating the same in either direction, means for generating electric impulses of different frequencies, readily controlled circuit-connections between said generating means and said individual registers for selectively determining the rate of actuation of any register, and a summation-register differentially geared to said individual registers to indicate the total of the actuations of said individual registers.

9. In combination, a plurality of registers provided each with electromagnetic means for actuating same in either direction, means for simultaneously generating electric impulses of different predetermined frequencies, sets of switch-terminals having connections with said generating means such that each set of terminals controls the impulses of a certain frequency independently of any other set, and a contact-terminal connected with each register adapted to coöperate with any switch-terminal for selectively establishing parallel circuit-connections between said generating means and any one or more registers to actuate the same at a rate dependent upon the particular switch-terminal with which any one register has connection.

10. In combination, a plurality of individual registers provided each with electromagnetic means for actuating the same in either direction, means for generating electric impulses of different predetermined frequencies, sets of switch-terminals having connections with said generating means such that each set of terminals controls the impulses of a certain frequency independently of any other set, a contact-terminal connected with each register adapted to coöperate with any switch-terminal for selectively establishing circuit-connections between said generating means and any one or more registers to actuate the same at a rate dependent upon the particular switch-terminal with which any one register has connection, and a summation-register controlled by said individual registers to indicate the total of the actuations of said individual registers.

11. In combination, a plurality of individual registers provided each with electromagnetic means for actuating the same in either direction, means for generating electric impulses of different predetermined frequencies, sets of switch-terminals having connections with said generating means such that each set of terminals controls the impulses of a certain frequency independently of any other set, a contact-terminal connected with each register adapted to coöperate with any switch-terminal for selectively establishing circuit-connections between said generating means and any one or more registers to actuate the same at a rate dependent upon the particular switch-terminal with which any one register has connection, and a summation-register differentially geared to said individual registers to indicate the total of the actuations of said individual registers.

12. In combination, a source of electric current, a plurality of time-controlled interrupting devices in circuit therewith for simultaneously sending current-impulses in parallel through the circuits at different predetermined frequencies, a set of switch-terminals connected with each interrupting device whereby each set of terminals controls the impulses of a certain frequency, a plurality of registers having each electromagnetic means adapted to be energized by said current-impulses for actuating the register in either direction, and a contact-terminal connected with each register adapted to cooperate with any switch-terminal for selectively establishing circuit-connections between said source and any one or more registers to actuate the same at a rate dependent upon the particular switch-terminal with which any one register has connection.

13. In combination, a source of electric current, a plurality of time-controlled interrupting devices in circuit therewith for sending current-impulses through the circuits at different predetermined frequencies, a set of switch-terminals connected with each interrupting device whereby each set of terminals controls the impulses of a certain frequency, a plurality of individual registers having each electromagnetic means adapted to be energized by said current-im-

pulses for actuating the register in either direction, a contact-terminal connected with each register adapted to coöperate with any switch-terminal for selectively establishing circuit-connections between said source and any one or more registers to actuate the same at a rate dependent upon the particular switch-terminal with which any one register has connection, and a summation-register controlled by said individual registers to indicate the total actuations of said individual registers.

14. In combination, a source of electric current, a plurality of time-controlled interrupting devices in circuit therewith for sending current-impulses through the circuits at different predetermined frequencies, a set of switch-terminals connected with each interrupting device whereby each set of terminals controls the impulses of a certain frequency, a plurality of individual registers having each electromagnetic means adapted to be energized by said current-impulses for actuating the register in either direction, a contact-terminal connected with each register adapted to coöperate with any switch-terminal for selectively establishing circuit-connections between said source and any one or more registers to actuate the same at a rate dependent upon the particular switch-terminal with which any one register has connection, and a summation-register differentially geared to said individual registers to indicate the total actuation of said individual registers.

15. In combination, a source of electric impulses of predetermined frequency, a plurality of wage-registers, a plurality of corresponding job-registers, electromagnetic means associated with each register for actuating the same in either direction at a rate dependent upon the said frequency, and circuit-connections between said source of impulses and said registers for connecting the wage-registers or any number thereof in parallel with their respective job-registers whereby any job-register may be cut out of circuit without affecting the actuation of the corresponding wage-register.

16. In combination, a source of electric impulses of predetermined frequency, a plurality of individual wage-registers, a plurality of corresponding individual job-registers, electromagnetic means associated with each register for actuating the same in either direction at a rate dependent upon the said frequency, circuit-connections between said source of impulses and said registers for connecting the wage-registers or any number thereof in parallel with their respective job-registers whereby any job-register may be cut out of circuit without affecting the actuation of the corresponding wage-register, a summation wage-register controlled by said individual wage-registers to indicate the total of the actuations of the individual wage-registers, and a summation job-register controlled by said individual job-registers to indicate the total of the actuations of the individual job-registers.

17. In combination, a source of electric impulses of predetermined frequency, a plurality of individual wage-registers, a plurality of corresponding individual job-registers, electromagnetic means associated with each register for actuating the same in either direction at a rate dependent upon the said frequency, circuit-connections between said source of impulses and said registers for connecting the wage-registers or any number thereof in parallel with their respective job-registers whereby any job-register may be cut out of circuit without affecting the actuation of the corresponding wage-register, a summation wage-register differentially geared to said individual wage-registers to indicate the total of the actuations of the individual wage-registers, and a summation job-register differentially geared to said individual job-registers to indicate the total of the actuations of the individual job-registers.

18. In combination, a source of electric impulses of predetermined frequency, a plurality of individual wage-registers, a plurality of corresponding individual job-registers, electromagnetic means associated with each register for actuating the same in either direction at a rate dependent upon the said frequency, circuit-connections between said source of impulses and said registers for connecting the wage-registers or any number thereof in parallel with their respective job-registers whereby any job-register may be cut out of circuit without affecting the actuation of the corresponding wage-register, a summation wage-register differentially geared to said individual wage-registers to indicate the total of the actuations of the individual wage-registers, a summation job-register differentially geared to said individual job-registers to indicate the total of the actuations of the individual job-registers, and a differential register geared to said summation-registers to indicate the difference between the amount of actuation of one summation-register and the amount of actuation of the other summation-register.

19. In combination, a source of electric impulses of predetermined frequency, a plurality of wage-registers, a plurality of corresponding job-registers, electromagnetic means associated with each register for actuating the same in either direction at a rate dependent upon the said frequency, and circuit-connections between said source of impulses and said registers for connecting the wage-registers or any number thereof in parallel with their respective job-registers, the points of connection being such that any

job-register may be cut out of circuit without affecting the actuation of the corresponding wage-register, but that no job-register may be cut into the actuating circuit when the corresponding wage-register is out of circuit.

20. In combination, means for generating electric impulses of different predetermined frequencies, a plurality of wage-registers, a plurality of job-registers, electromagnetic means associated with each register for actuating the same in either direction, sets of switch-terminals having connections with said generating means such that each set of terminals controls the impulses of a certain frequency independently of any other set, and a contact-terminal connected with each register adapted to coöperate with any switch-terminal for selectively establishing circuit-connections between said generating means, and any one or more registers to actuate the same at a rate dependent upon the particular switch terminal with which any one register has connection, said circuit-connections being such that any job-register may be cut out of circuit without affecting the corresponding wage register.

21. In combination, means for generating electric impulses of different predetermined frequencies, a plurality of individual wage-registers, a plurality of individual job-registers, electromagnetic means associated with each register for actuating the same in either direction, sets of switch-terminals having connections with said generating means such that each set of terminals controls the impulses of a certain frequency independent of any other set, a contact-terminal connected with each register adapted to coöperate with any switch-terminal for selectively establishing circuit-connections between said generating means and any one or more registers to actuate the same at a rate dependent upon the particular switch-terminal with which any one register has connection, said circuit-connections being such that any job-register may be cut out of circuit without affecting the actuation of the corresponding wage-register, a summation wage-register controlled by said individual wage-registers to indicate the total of the actuations of the individual wage-registers, and a summation job-register controlled by said individual job-registers to indicate the total of the actuations of the individual job-registers.

22. In combination, means for generating electric impulses of different predetermined frequencies, a plurality of individual wage-registers, a plurality of individual job-registers, means associated with each register for actuating the same in either direction, sets of switch-terminals having connections with said generating means such that each set of terminals controls the impulses of a certain frequency independent of any other set, a contact-terminal connected with each register adapted to coöperate with any switch-terminal for selectively establishing circuit-connections between said generating means and any one or more registers to actuate the same at a rate dependent upon the particular switch-terminal with which any one register has connection, said circuit-connections being such that any job-register may be cut out of circuit without affecting the actuation of the corresponding wage-register, a summation wage-register differentially geared to said individual wage-registers to indicate the total of the actuations of the individual wage-registers, and a summation job-register differentially geared to said individual job-registers to indicate the total of the actuations of the individual job-registers.

23. In combination, means for generating electric impulses of different predetermined frequencies, a plurality of individual wage-registers, a plurality of individual job-registers, electromagnetic means associated with each register for actuating the same in either direction, sets of switch-terminals having connections with said generating means such that each set of terminals controls the impulses of a certain frequency independent of any other set, a contact-terminal connected with each register adapted to coöperate with any switch-terminal for selectively establishing circuit-connections between said generating means and any one or more registers to actuate the same at a rate dependent upon the particular switch-terminal with which any one register has connection, said circuit-connections being such that any job-register may be cut out of circuit without affecting the actuation of the corresponding wage-register, a summation wage-register differentially geared to said individual wage-registers to indicate the total of the actuations of the individual wage-registers, a summation job-register differentially geared to said individual job-registers to indicate the total of the actuations of the individual job-registers, and a differential register geared to said summation-registers to indicate the difference between the amount of actuation of one summation-register and the amount of actuation of the other summation-register.

24. In combination, means for generating electric impulses of different predetermined frequencies, a plurality of wage-registers, a plurality of job-registers, electromagnetic means associated with each register for actuating the same in either direction, sets of switch-terminals having connections with said generating means such that each set of terminals controls the impulses of a certain frequency independently of any other set, and a contact-termi-

nal connected with each register adapted to coöperate with any switch-terminal to selectively establish circuit-connections between said generating means and any one or more registers to actuate the same at a rate dependent upon the particular switch-terminal with which the register has connection, said circuit-connections being such that any job-register may be cut out of circuit without affecting the actuation of the corresponding wage-register, but that no job-register may be cut into the actuating circuit when the corresponding wage-register is out of circuit.

25. In combination, a source of electric impulses of predetermined frequency, a plurality of wage-registers, a plurality of corresponding time-registers, electromagnetic means associated with each register for actuating the same in either direction at a rate dependent upon the said frequency, circuit-connections between said source of impulses and said registers for cutting said registers or any number thereof into or out of the energizing circuit, and an interconnection between the circuit of every wage-register and the circuit of the corresponding time-register to compel simultaneous control of said circuits.

26. In combination, a source of electric impulses of predetermined frequency, a plurality of wage-registers, a plurality of corresponding job-registers, a plurality of corresponding time-registers, electromagnetic means associated with each register for actuating the same in either direction at a rate dependent upon the said frequency, circuit-connections between said source of impulses and said registers, for cutting said registers or any number thereof into or out of the energizing circuit, an interconnection between the circuit of every wage-register and the circuit of the corresponding job-register whereby any job-register may be cut out of circuit without affecting the actuation of the corresponding wage-register, and an interconnection between the circuit of every wage-register and the circuit of the corresponding time-register to compel simultaneous control of said circuits.

27. In combination, a source of electric impulses of predetermined frequency, a plurality of wage-registers, a plurality of corresponding job-registers, a plurality of corresponding time-registers, electromagnetic means associated with each register for actuating the same in either direction at a rate dependent upon the said frequency, circuit-connections between said source of impulses and said registers for cutting said registers or any number thereof into or out of the energizing circuit, an interconnection between the circuit of every wage-register and the circuit of the corresponding job-register, such that any job-register may be cut out of circuit without affecting the actuation of the corresponding wage-register, but that no job-register may be cut into the actuating circuit when the corresponding wage-register is out of circuit, and an interconnection between the circuit of every wage-register and the circuit of the corresponding time-register to compel simultaneous control of said circuits.

28. In combination, means for generating electric impulses of different predetermined frequencies, a plurality of wage-registers, a plurality of corresponding job-registers, a plurality of corresponding time-registers, electromagnetic means associated with each register for actuating the same in either direction at a rate dependent upon the frequency of the energizing impulses, sets of switch-terminals having connections with said generating means such that each set of terminals controls the impulses of a certain frequency independently of any other set, a contact-terminal connected with each register adapted to coöperate with any switch-terminal for selectively establishing circuit-connections between said generating means and any one or more registers to actuate the same at a rate dependent upon the particular switch-terminal with which the register has connection, said circuit-connections being such that any job-register may be cut out of circuit without affecting the actuation of the corresponding wage-register, and circuit-connections between said generating means and said time-registers for actuating any one or more of said time-registers at the same predetermined rate irrespective of the rates of actuation of the corresponding wage-registers.

29. In combination, means for generating electric impulses of different predetermined frequencies, a plurality of wage-registers, a plurality of corresponding job-registers, a plurality of corresponding time-registers, electromagnetic means associated with each register for actuating the same in either direction at a rate dependent upon the frequency of the energizing impulses, sets of switch-terminals having connections with said generating means such that each set of terminals controls the impulses of a certain frequency independently of any other set, a contact-terminal connected with each register adapted to coöperate with any switch-terminal for selectively establishing circuit-connections between said generating means and any one or more registers to actuate the same at a rate dependent upon the particular switch-terminal with which the register has connection, circuit-connections between said generating means and said time-registers for actuating any one or more of said time-registers at the same predetermined rate irrespective of the rates of actuation of the corresponding wage-registers, an intercon-

nection between the circuit of every wage-register and the circuit of the corresponding job-register, whereby any job-register may be cut out of circuit without affecting the actuation of the corresponding wage-registers, and an interconnection between the circuit of every wage-register and the circuit of the corresponding time-register to compel simultaneous control of said circuits.

30. In combination, means for generating electric impulses of different predetermined frequencies, a plurality of wage-registers, a plurality of corresponding job-registers, a plurality of corresponding time-registers, electromagnetic means associated with each register for actuating the same in either direction at a rate dependent upon the frequency of the energizing impulses, sets of switch-terminals having connections with said generating means such that each set of terminals controls the impulses of a certain frequency independently of any other set, a contact-terminal connected with each register adapted to coöperate with any switch-terminal for selectively establishing circuit-connections between said generating means and any one or more registers to actuate the same at a rate dependent upon the particular switch-terminal with which the register has connection, circuit-connections between said generating means and said time-registers for actuating any one or more of said time-registers at the same predetermined rate irrespective of the rates of actuation of the corresponding wage-registers, an interconnection between the circuit of every wage-register and the circuit of the corresponding job-register such that any job-register may be cut out of circuit without affecting the actuation of the corresponding wage-register, but that no job-register may be cut into the actuating circuit when the corresponding wage-register is out of circuit, and an interconnection between the circuit of every wage-register and the circuit of the corresponding time-register to compel simultaneous control of said circuits.

31. In combination, a source of electric impulses of predetermined frequency, a plurality of wage-registers, a plurality of corresponding job-registers, electromagnetic means associated with each register for actuating the same in either direction at a rate dependent upon the said frequency, and circuit-connections between said source of impulses and said registers for connecting a plurality of the wage-registers each in series with its corresponding job-register and all of such pairs in parallel to compel simultaneous actuation of any wage-register and its corresponding job-register.

32. In combination, a means for generating electric impulses of different predetermined frequencies, a plurality of wage-registers, a plurality of job-registers, electromagnetic means associated with each register for actuating the same in either direction, sets of switch-terminals having connections with said generating means such that each set of terminals controls the impulses of a certain frequency independently of any other set, a contact-terminal connected with each register adapted to coöperate with any switch-terminal to selectively establish parallel circuit-connections between said generating means and a plurality of registers to actuate the same at rates dependent upon the particular switch-terminals with which the registers have connection, said circuit-connections compelling simultaneous actuation of any wage-register and its corresponding job-register.

33. In combination, means for generating electric impulses of different predetermined frequencies, a plurality of wage-registers, a plurality of corresponding job-registers, a plurality of corresponding time-registers, electromagnetic means associated with each register for actuating the same in either direction at a rate dependent upon the frequency of the energizing impulses, sets of switch-terminals having connections with said generating means such that each set of terminals controls the impulses of a certain frequency independently of any other set, a contact-terminal connected with each register adapted to coöperate with any switch-terminal for selectively establishing circuit-connections between said generating means and any one or more registers to actuate the same at a rate dependent upon the particular switch-terminal with which the register has connection, said circuit-connections compelling the simultaneous actuation of any wage-register and its corresponding job-register, and circuit connections between said generating means and said time-registers for actuating any one or more of said time-registers at the same predetermined rate irrespective of the rates of actuation of the corresponding wage-registers.

34. In combination, means for generating electric impulses of different predetermined frequencies, a plurality of wage-registers, a plurality of corresponding job-registers, a plurality of corresponding time-registers, electromagnetic means associated with each register for actuating the same in either direction at a rate dependent upon the frequency of the energizing impulses, sets of switch-terminals having connections with said generating means such that each set of terminals controls the impulses of a certain frequency independently of any other set, a contact-terminal connected with each register adapted to coöperate with any switch-terminal for selectively establishing circuit-connections between said generating means and any one or more registers to actuate the same at a rate dependent upon the particu-

lar switch-terminal with which the register has connection, said circuit-connections compelling the simultaneous actuating of any wage-register and its corresponding job-register, circuit-connections between said generating means and said time-registers for actuating any one or more of said time-registers at the same predetermined rate irrespective of the rates of actuation of the corresponding wage-registers, and an interconnection between the circuit of every wage-register and the circuit of the corresponding time-register to compel simultaneous control of said circuits.

35. In an electromagnetic accounting system, the combination of a pair of ratchet wheels rigidly held together, an actuating pawl for each ratchet wheel, a common controlling mechanism for said pawls and adjustable to permit one or the other of the pawls to engage its corresponding ratchet wheel, and electromagnetic means for intermittently actuating said pawls to cause a step-by-step movement of the ratchet wheels in a direction dependent upon the position of the controlling mechanism.

36. In an electromagnetic accounting system, the combination of a pair of ratchet wheels rigidly held together, an actuating pawl for each ratchet wheel, a common controlling mechanism for said pawls and adjustable to permit one or the other of the pawls to engage its corresponding ratchet wheel, electromagnetic means for intermittently actuating said pawls to cause a step-by-step movement of the ratchet wheels in a direction dependent upon the position of the controlling mechanism, and retaining means under the control of said mechanism for positively preventing reverse rotation of the ratchet wheels during such step-by-step movement.

37. In an electromagnetic accounting system, the combination of a pair of ratchet wheels rigidly held together, a movable lever associated with said ratchet wheels, a pair of pawls carried by said lever and arranged each to coöperate with the teeth of a ratchet wheel for actuating said ratchet wheels in either direction, a common controlling mechanism for said pawls and adjustable to permit one or the other of the pawls to engage its corresponding ratchet wheel, and electromagnetic means for intermittently actuating said lever to cause a step-by-step movement of the ratchet wheels in a direction dependent upon the position of the controlling mechanism.

38. In an electromagnetic accounting system, the combination of a pair of ratchet wheels rigidly held together, a movable lever associated with said ratchet wheels, a pair of pawls carried by said lever and arranged each to coöperate with the teeth of a ratchet wheel for actuating said ratchet wheels in either direction, a common controlling mechanism for said pawls and adjustable to permit one or the other of the pawls to engage its corresponding ratchet wheel, electromagnetic means for intermittently actuating said lever to cause a step-by-step movement of the ratchet wheels in a direction dependent upon the position of the controlling mechanism, and retaining means under the control of said mechanism for positively preventing reverse rotation of the ratchet wheels during such step-by-step movement.

39. In an electromagnetic accounting system, the combination of a pair of ratchet wheels rigidly held together, a pivoted lever associated with said ratchet wheels, a pair of pivoted pawls carried on one end of said lever to coöperate each with the teeth of a ratchet wheel for actuating said ratchet wheels in either direction, a common controlling mechanism for said pawls and adjustable to permit one or the other of the pawls to engage its corresponding ratchet wheel, an armature connected with said lever near its other end, an electromagnet for actuating said armature, means for normally holding the armature away from the electromagnet, and means for intermittently energizing said electromagnet to cause a step-by-step movement of the ratchet wheels in a direction dependent upon the position of the controlling mechanism.

40. In an electromagnetic accounting system, the combination of a pair of ratchet wheels rigidly held together, a pivoted lever associated with said ratchet wheels, a pair of pivoted pawls carried on one end of said lever to coöperate each with the teeth of a ratchet wheel for actuating said ratchet wheels in either direction, a common controlling mechanism for said pawls and adjustable to permit one or the other of the pawls to engage its corresponding ratchet wheel, an armature connected with said lever near its other end, an electromagnet for actuating said armature, means for normally holding the armature away from the electromagnet, means for intermittently energizing said electromagnet to cause a step-by-step movement of the ratchet wheels in a direction dependent upon the position of the controlling mechanism, and retaining means under the control of said mechanism for positively preventing reverse rotation of the ratchet wheels during such step-by-step movement.

41. In an electromagnetic accounting system, the combination of a shaft, a pair of ratchet wheels mounted thereon, said wheels being rigidly held together, a movable lever associated with said ratchet wheels, a pair of pawls carried by said lever, one of said pawls being arranged to engage the teeth of one of the ratchet wheels for actuating the same in one direction, the other pawl being

arranged to engage the teeth of the other ratchet wheel for actuating the same in the opposite direction, readily adjustable mechanism for holding either of the pawls out of operative position while the other pawl is in its operative position, and electromagnetic means for intermittently actuating said lever to cause a step-by-step movement of the ratchet wheels in a direction dependent upon the position of said mechanism.

42. In an electromagnetic accounting system, the combination of a shaft, a pair of ratchet wheels mounted thereon, said wheels being rigidly held together, a pivoted lever associated with said ratchet wheels, a pair of pawls pivoted near one end of said lever, one of said pawls being arranged to engage the teeth of one of the ratchet wheels for actuating the same in one direction, the other pawl being arranged to engage the teeth of the other ratchet wheel for actuating the same in the opposite direction, an armature carried by said lever near its other end, readily adjustable mechanism for holding either of the pawls out of operative position while the other pawl is in its operative position, an electromagnet for actuating said armature, means for normally holding the armature away from the electromagnet, and means for intermittently energizing said electromagnet to cause a step-by-step movement of the ratchet wheels in a direction dependent upon the position of said mechanism.

43. In an electromagnetic accounting system, the combination of a shaft, a pair of ratchet wheels mounted thereon, said wheels being rigidly held together, a movable lever associated with said ratchet wheels, a pair of pawls carried by said lever, one of said pawls being arranged to engage the teeth of one of the ratchet wheels for actuating the same in one direction, the other pawl being arranged to engage the teeth of the other ratchet wheel for actuating the same in the opposite direction, readily adjustable mechanism for holding either of the pawls out of operative position while the other pawl is in its operative position, electromagnetic means for intermittently actuating said lever to cause a step-by-step movement of the ratchet wheels in a direction dependent upon the position of said mechanism, and retaining means controlled by said mechanism for preventing reverse rotation of the ratchet wheels during such step-by-step movement.

44. In an electromagnetic accounting system, the combination of a shaft, a pair of ratchet wheels mounted thereon, said wheels being rigidly held together, a pivoted lever associated with said ratchet wheels, a pair of pawls pivoted near one end of said lever, one of said pawls being arranged to engage the teeth of one of the ratchet wheels for actuating the same in one direction, the other pawl being arranged to engage the teeth of the other ratchet wheel for actuating the same in the opposite direction, an armature carried by said lever near its other end, readily adjustable mechanism for holding either of the pawls out of operative position while the other pawl is in its operative position, an electromagnet for actuating said armature, means for normally holding the armature away from the electromagnet, means for intermittently energizing said electromagnet to cause a step-by-step movement of the ratchet wheels in a direction dependent upon the position of said mechanism, and retaining means controlled by said mechanism for positively preventing reverse rotation of the ratchet wheels during such step-by-step movement.

45. In an electromagnetic accounting system, the combination of a shaft, a pair of ratchet wheels mounted thereon, said wheels being rigidly held together, a movable lever associated with said ratchet wheels, a pair of pawls carried by said lever, one of said pawls being arranged to engage the teeth of one of the ratchet wheels for actuating the same in one direction, the other pawl being arranged to engage the teeth of the other ratchet wheel for actuating the same in the opposite direction, a readily adjustable rod having extensions at its inner end in engagement with said pawls, whereby adjustment of the rod in one direction causes one of the pawls to move into operative position and the other pawl to move into inoperative position, while adjustment of the rod in the opposite direction reverses the position of the pawls, and electromagnetic means for intermittently actuating said lever to cause a step-by-step movement of the ratchet wheels in a direction dependent upon the position of said adjustable rod.

46. In an electromagnetic accounting system, the combination of a shaft, a pair of ratchet wheels mounted thereon, said wheels being rigidly held together, a movable lever associated with said ratchet wheels, a pair of pawls carried by said lever, one of said pawls being arranged to engage the teeth of one of the ratchet wheels for actuating the same in one direction, the other pawl being arranged to engage the teeth of the other ratchet wheel for actuating the same in the opposite direction, a readily adjustable rod having extensions at its inner end in engagement with said pawls, whereby adjustment of the rod in one direction causes one of the pawls to move into operative position and the other pawl to move into inoperative position, while adjustment of the rod in the opposite direction reverses the position of the pawls, electromagnetic means for intermittently actuating said lever to cause a step-by-step movement of the ratchet wheels in a direction dependent upon the position of said ad-

justable rod, and a retaining dog for each ratchet wheel controlled by the position of the rod for positively preventing reverse rotation of the ratchet wheels during such step-by-step movement.

47. In an electromagnetic accounting system, the combination of a shaft, a pair of ratchet wheels mounted thereon, said wheels being rigidly held together, a movable lever associated with said ratchet wheels, a pair of pawls carried by said lever, one of said pawls being arranged to engage the teeth of one of the ratchet wheels for actuating the same in one direction, the other pawl being arranged to engage the teeth of the other ratchet wheel for actuating the same in the opposite direction, an adjustable rod provided with extensions at its inner end, a slidable connection between one extension and one of the pawls, a separable connection between the other extension and the other of the pawls to cause the slidable connection upon outward movement of the rod to lift the corresponding pawl away from the teeth of the associated ratchet wheel, and the separable connection to be interrupted to permit the other pawl to drop into engagement with the teeth of the other ratchet wheel, the pawls being restored to their normal position by the inward movement of rod, and electromagnetic means for intermittently actuating said lever to cause a step-by-step movement of the ratchet wheels in a direction dependent upon the position of said adjustable rod.

48. In an accounting system, a series of ratchet wheels arranged in pairs, the wheels of each pair being rigidly held together, differential gear-mechanism for each pair of ratchet wheels and comprising a central gear with which the associated ratchet wheels are operatively connected, a pinion rotatably mounted upon said central gear, a pair of driving gears upon either side of the central gear and in engagement with said pinion, means for operatively connecting together the adjacent driving gears of the successive gear-mechanism, the first of the driving gears in the series being held stationary, whereby the rate of actuation of the last driving gear represents the sum of the rates of actuation of the other driving gears, an actuating pawl for each ratchet wheel, adjustable controlling mechanism for each of certain alternate pairs of pawls to normally permit corresponding pawls of each pair to engage their respective wheels for actuating the same in one direction, adjustable controlling mechanism for each of the other alternate pairs of pawls to normally permit corresponding pawls of each of said pairs to engage their respective ratchet wheels for actuating the same in the reverse direction, electromagnetic means for intermittently actuating the pawls to cause a step-by-step movement of the ratchet wheels in a direction dependent upon the position of the respective controlling mechanism.

49. In an accounting system, a series of ratchet wheels arranged in pairs, the wheels of each pair being rigidly held together, differential gear-mechanism for each pair of ratchet wheels, a shaft upon which the gear-mechanisms are loosely mounted, each gear-mechanism comprising a central gear with which the associated ratchet wheels are operatively connected, a pinion rotatably mounted upon said central gear, a pair of driving gears upon either side of the central gear and in engagement with said pinion, sleeves on said shaft for rigidly connecting together the adjacent driving gears of the successive gear-mechanisms, the first of the driving gears in the series being held stationary, whereby the rate of actuation of the last driving gear represents the sum of the rates of actuation of the other driving gears, an actuating pawl for each ratchet wheel, adjustable controlling mechanism for each of certain alternate pairs of pawls to normally permit corresponding pawls of each pair to engage their respective ratchet wheels for actuating the same in one direction, adjustable controlling mechanism for each of the other alternate pairs of pawls to normally permit corresponding pawls of each of said pairs to engage their respective ratchet wheels for actuating the same in the reverse direction, electromagnetic means for intermittently actuating the pawls to cause a step-by-step movement of the ratchet wheels in a direction dependent upon the position of the respective controlling mechanism.

50. In an accounting system, a shaft, a series of ratchet wheels loosely arranged thereon in pairs, the wheels of each pair being rigidly held together, a differential gear-mechanism for each pair of ratchet wheels loosely mounted on said shaft, each gear-mechanism comprising a central gear secured to one of the associated ratchet wheels to rotate therewith, a pinion rotatably mounted upon said central gear, a pair of driving gears upon either side of the central gear and in engagement with said pinion, sleeves on said shaft for rigidly connecting together the adjacent driving gears of the successive gear mechanisms, the first of the driving gears in the series being held stationary, whereby the rate of actuation of the last driving gear represents the sum of the rates of actuation of the other driving gears, an actuating pawl for each ratchet wheel, adjustable controlling mechanism for each of certain alternate pairs of pawls to normally permit corresponding pawls of each pair to engage their respective ratchet wheels for actuating the same in one direc-

tion, adjustable controlling mechanism for each of the other alternate pairs of pawls to normally permit corresponding pawls of each of said pairs to engage their respective ratchet wheels for actuating the same in the reverse direction, electromagnetic means for intermittently actuating the pawls to cause a step-by-step movement of the ratchet wheels in a direction dependent upon the position of the respective controlling mechanism.

51. In an accounting system, a pair of ratchet wheels rigidly held together, an actuating pawl for each ratchet wheel and arranged to be moved into and out of engagement with the teeth thereof, an electromagnet for operating said pawls, means for subjecting said electromagnet to predetermined current impulses in successive cycles to cause a step-by-step movement of the ratchet wheels in a direction dependent upon the position of the pawls, the current-impulses of a cycle being first in one direction and then in the other without affecting the operation of said electromagnet, a series of uniformly spaced projections on one of the ratchet wheels, a movable arm, and electromagnetic means controlled by said alternations of current-impulses to actuate said movable arm out of and into the path of travel of said projections for compelling synchronism during the normal operation of the device between every cycle of impulses and the accompanying movement of the ratchet wheels.

52. In an accounting system, a pair of ratchet wheels rigidly held together, an actuating pawl for each ratchet wheel, a common controlling mechanism for said pawls adjustable to permit one or the other of said pawls to engage its corresponding ratchet wheel, an electromagnet for operating said pawls, means for subjecting said electromagnet to predetermined current impulses in successive cycles to cause a step-by-step movement of the ratchet wheels in a direction dependent upon the position of the controlling mechanism, the current impulses of a cycle being first in one direction and then in the other without affecting the operation of said electromagnet, a series of uniformly spaced projections on one of the ratchet wheels, a movable arm, and electromagnetic means controlled by said alternations of current-impulses to actuate said movable arm out of and into the path of travel of said projections for compelling synchronism during the normal operation of the device between every cycle of impulse and the accompanying movement of the ratchet wheels.

53. In an accounting system, a pair of ratchet wheels rigidly held together, an actuating pawl for each ratchet wheel and arranged to be moved into and out of engagement with the teeth thereof, an electromagnet for operating said pawls, means for subjecting said electromagnet to predetermined current impulses in successive cycles to cause a step-by-step movement of the ratchet wheels in a direction dependent upon the position of the pawls, the current impulses of a cycle being first in one direction and then in the other without affecting the operation of said electromagnet, a series of uniformly spaced projections on one of the ratchet wheels, a movable arm, and a polarized electromagnet in the circuit of said current-impulses for actuating said arm out of and into the path of travel of said projections, depending upon the direction of the energizing current impulse, to compel synchronism during the normal operation of the device between every cycle of impulses and the accompanying movement of the ratchet wheels.

54. In an accounting system, a pair of ratchet wheels rigidly held together, an actuating pawl for each ratchet wheel and arranged to be moved into and out of engagement with the teeth thereof, an electromagnet for operating said pawls, a source of electric current, circuit-connections between said source and the winding of said electromagnet, a series of uniformly spaced projections on one of the ratchet wheels, a movable arm, clock-regulated interrupting and reversing mechanism for periodically making and breaking said circuit and reversing the direction of current impulse therethrough in successive cycles to cause a step-by-step movement of the ratchet wheels in a direction dependent upon the position of the pawls, and electromagnetic means connected with said circuit and controlled by said reversal of current-impulses to actuate the movable arm out of and into the path of travel of said projections for compelling synchronism during the normal operation of the device between every cycle of impulses and the accompanying movement of the ratchet wheels.

55. In an accounting system, a pair of ratchet wheels rigidly held together, an actuating pawl for each ratchet wheel and arranged to be moved into and out of engagement with the teeth thereof, an electromagnet for operating said pawls, a source of electric current, circuit-connections between said source and the winding of said electromagnet, a series of uniformly spaced projections on one of the ratchet wheels, a movable arm, clock-regulated interrupting and reversing mechanism for periodically making and breaking said circuit and reversing the direction of current-impulses therethrough in successive cycles to cause a step-by-step movement of the ratchet wheels in a direction dependent upon the position of the pawls, and a polarized electromagnet in

said circuit and controlled by said reversal of current-impulses to actuate the movable arm out of and into the path of travel of said projections for compelling synchronism during the normal operation of the device between every cycle of impulses and the accompanying movement of the ratchet wheels.

56. In an accounting system, a pair of ratchet wheels rigidly held together, an actuating pawl for each ratchet wheel adapted to be moved into and out of engagement with the teeth thereof for determining the direction of rotation of the ratchet wheels, a series of uniformly spaced projections on one of the ratchet wheels, an electromagnet for operating said pawls, means for subjecting said electromagnet to predetermined current impulses in successive cycles to cause a step-by-step movement of the ratchet wheels in a direction dependent upon the position of the pawls, the arc of travel of the ratchet wheels during a cycle normally tending to be greater than the arc between adjacent projections, and electromagnetic means controlled by said current-impulses in the normal operation of the device for positively limiting the arc of travel of the ratchet wheels during a cycle to the arc between adjacent projections.

57. In an accounting system, a pair of ratchet wheels rigidly held together, an actuating pawl for each ratchet wheel adapted to be moved into and out of engagement with the teeth thereof for determining the direction of rotation of the ratchet wheels, a series of uniformly spaced projections on one of the ratchet wheels, an electromagnet for operating said pawls, a source of electric current, circuit-connections between said source and the winding of said electromagnet, clock-regulated interrupting and reversing mechanism for periodically making and breaking said circuit and reversing the direction of current-impulse therethrough in successive cycles to cause a step-by-step movement of the ratchet wheels in a direction dependent upon the position of the pawls, the arc of travel of the ratchet wheels during a cycle normally tending to be greater than the arc between adjacent projections, a movable arm, a polarized electromagnet controlled by the reversal of current-impulse to actuate said movable arm into the path of travel of said projections for positively limiting the arc of movement of the ratchet wheels during a cycle to the arc between adjacent projections, in the normal operation of the device.

58. In an accounting system, a pair of ratchet wheels rigidly held together, an actuating pawl for each ratchet wheel and adapted to be moved into and out of engagement with the teeth thereof, an electromagnet for operating said pawls to cause a step-by-step movement of the ratchet wheels in a direction dependent upon the position of the pawls, a source of electric current, circuit connections between the winding of said electromagnet and said source, a time-controlled shaft, a disk mounted thereon and having a peripheral groove with lateral deviations extending in opposite directions, said deviations being arranged in like recurring sets, a pair of circuit terminals associated with said disk and connected with said source of current, a contact-member having one end working in said groove and adapted to be moved by said deviations into engagement with said terminals during the rotation of the disk, the deviations in one direction forcing each the contact member against one of the terminals to make and break the circuit through said electromagnet in one direction, the deviations in the other direction forcing each the contact member against the other terminal to make and break the circuit through the electromagnet in the reverse direction, the current impulses thus sent through the circuit by each successive set of deviations constituting a cycle, a series of uniformly spaced projections on one of the ratchet wheels, a movable arm, and a polarized electromagnet controlled by the reversal of current-flow through the circuit to actuate said movable arm out of and into the path of travel of said projections for compelling synchronism during the normal operation of the device between every cycle of impulses and the accompanying movement of the ratchet wheels.

59. In an accounting system, a pair of ratchet wheels rigidly held together, an actuating pawl for each ratchet wheel adapted to be moved into and out of engagement with the teeth thereof for determining the direction of rotation of the ratchet wheels, a series of uniformly spaced projections on one of the ratchet wheels, an electromagnet for operating said pawls, a source of electric current, circuit-connections between the winding of said electromagnet and said source, a time-controlled shaft, a disk mounted thereon and having a peripheral groove with lateral deviations extending in opposite directions, said deviations being arranged in like recurring sets, a pair of circuit-terminals associated with said disk and connected with said source of current, a contact-member having one end working in said groove and adapted to be moved by said deviations into engagement with said terminals during the rotation of the disk, the deviations in one direction forcing each the contact member against one of the terminals to make and break the circuit through said electromagnet in one direction, the deviations in the other direction forcing each

the contact member against the other terminal to make and break the circuit through the electromagnet in the reverse direction, the current impulses thus sent through the circuit by each successive set of deviations constituting a cycle and causing actuation of the ratchet wheels through an arc normally tending to be greater than the arc between adjacent projections, a movable arm, and a polarized electromagnet operated by the reversal of current-flow to actuate said movable arm into the path of travel of said projections for positively limiting the arc of movement of the ratchet wheels during a cycle to the arc between adjacent projections, in the normal operation of the device.

60. In combination, a plurality of individual registers provided each with electromagnetic means for actuating the same in either direction, a source of electric impulses for periodically energizing said electromagnetic means to operate the registers at a rate determined by the frequency of the impulses, a summation-register geared to said individual registers to indicate the total of the actuations of said individual registers, and a mechanical locking device associated with each register for securing the same against movement beyond zero-position during decumulation.

61. In combination, a plurality of registers provided each with electromagnetic means for actuating the same in either direction, a source of electric impulses of predetermined frequency, a series of switch-terminals connected with said source, a coöperating contact-terminal connected with each register for establishing readily separable circuit-connections between said source and any register or registers to operate the same at a rate dependent upon said frequency, and a mechanical locking device associated with each register for securing the same against movement beyond zero-position during decumulation.

62. In combination, a plurality of registers provided each with electromagnetic means for actuating same in either direction, means for generating electric impulses of different predetermined frequencies, sets of switch-terminals having connections with said generating means such that each set of terminals controls the impulses of a certain frequency independently of any other set, a contact-terminal connected with each register adapted to coöperate with any switch-terminal for selectively establishing circuit-connections between said generating means and any one or more registers to actuate the same at a rate dependent upon the particular switch-terminal with which any one register has connection, and a mechanical locking device associated with each register for securing the same against movement beyond zero-position during decumulation.

63. In combination, a rate disk, a register, actuating mechanism between the disk and the register, and means for electrically decumulating the register.

64. In combination, a disk having a waveform groove, contact mechanism controlled by the groove, a register controlled as to its operation by means of the contact mechanism, and means for electrically decumulating the register.

65. In combination, a disk, a register, and electrical devices operated by the disk for accumulating and decumulating the register.

In witness whereof, I hereunto subscribe my name this 29 day of March, 1910.

ARTHUR F. POOLE.

Witnesses:

HARVEY L. HANSON,

ADOLPH A. THOMAS.